Idaho Department of Fish and Game

# Dworshak Reservoir Quarterly Report

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Figure 1. Dworshak dam and reservoir in winter.

**Points of Interest:**

- Higher fish detection rates in front of operating turbines, with higher than normal winter discharge rates.
- Fish detection rates (entrainment potential) in front of turbine units greater during night and dawn periods.
- Kokanee densities near dam remain low due to low overall kokanee abundance and density this year.
- Water velocities upstream of turbine three intake opening much lower than expected at near maximum discharge rate.
- Analysis of strobe light effectiveness tests near complete.
- Starting new limnology and trawl sampling next quarter.

## Kokanee Entrainment Assessment

The U.S. Army Corps of Engineers increased discharge through the turbines several times this quarter for increased power production. Typically dam operations maintain a minimum discharge of 1,400 cubic feet per second (cfs) through a single turbine during the winter. Yet, these operations allowed us to sample in front of turbine intakes two and three and at higher discharges.

This on-going entrainment monitoring provides basic information on the number of detected fish immediately in front of operating turbines and reservoir outlets (ROs), representative of entrainment vulnerability. This information helps to predict the degree of variability in fish entrainment expected between time of day, seasons, discharge rate, and intake openings.

We sampled one 24 hr period in January and two or more 24 hr periods in both February and March. More fish were detected this winter than in previous winters, most likely due to the higher than normal discharge. The highest fish detection rate was observed in front of turbine three on February 18th (7.8 fish/hr) and lowest in front of turbine one on January 14th (0.5 fish/hr). In general, the higher the turbine discharge rate the more fish we detected in front of respective turbines (Table 1).

Over four times as many fish were detected during night and dawn periods than during day and dusk periods (Figure 2). This higher susceptibility to entrainment during the night, suggests strobe lights, which are likely more effective in the dark, have great potential for substantially reducing kokanee entrainment losses.

Table 1. Turbine intake, discharge rate, and detection rate of fish obtained from fixed-site hydroacoustic sampling, January through March, 2004.

| Date | Turbine # | Discharge (cfs) | Detection (fish/hr) |
|---|---|---|---|
| 1/14/04 | 1 | 1,500 | 0.5 |
| 2/18/04 | 3 | 5,800 | 7.8 |
| 2/23/04 | 2 | 2,400 | 1.9 |
| 2/26/04 | 2 | 2,400 | 2.6 |
| 3/23/04 | 1 | 1,400 | 1.5 |
| 3/24/04 | 1 | 1,400 | 3.2 |

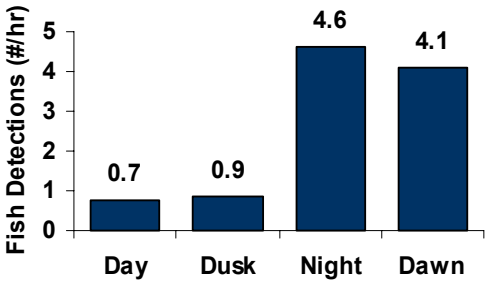


Figure 2. Average fish detection rate (#/hr) in front of discharging turbines for each of four time of day strata, obtained from fixed-site hydroacoustic sampling, January – March, 2004.

## Kokanee Densities near Dworshak Dam

Monthly hydroacoustic surveys within the forebay of the reservoir were conducted again this quarter. These surveys help determine the time of the year most critical for kokanee entrainment losses.

Fish densities near the dam remained very low this winter, but were higher than last winter. Kokanee densities only reached 70 and 57 fish/acre this February and March respectively (Figure 3). No data was collected in January due to equipment problems. This year's densities near the dam are much lower than in 2002, likely because the total kokanee abundance in the Reservoir is much less.

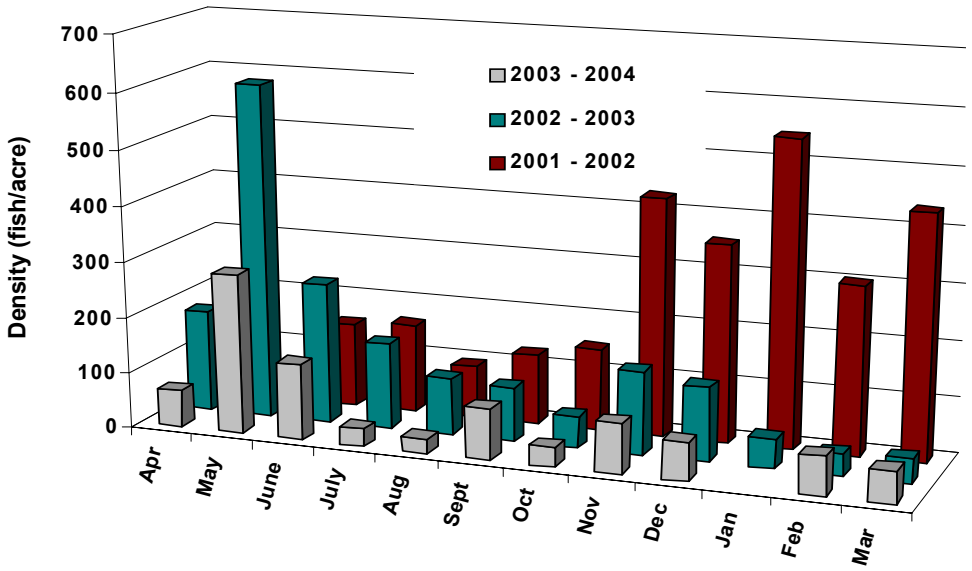


Figure 3. Average kokanee densities (#/acre) in the forebay of Dworshak Dam, Idaho; obtained from monthly hydroacoustic sampling, June, 2001 through March, 2004.

## Water Velocities in front of Turbine Three Intake Opening

We recently conducted water velocity sampling in the forebay of Dworshak Reservoir in front of turbine unit three. Unit three was operated for a short time in mid February. Sampling was conducted while discharging 5,800 cfs, which is near maximum discharge for this turbine unit.

This work helps to determine the appropriate construction and safe placement of strobe lights to deter kokanee entrainment through the turbine unit openings.

Our results reveal water velocities up to 1.7 ft/sec at 10 feet from the dam in the middle of the intake opening (Figure 4). However, velocities drop quickly with distance from the intake opening. Water velocities drop below 1.0 ft/sec at distances greater than 10 feet from the face of the dam.

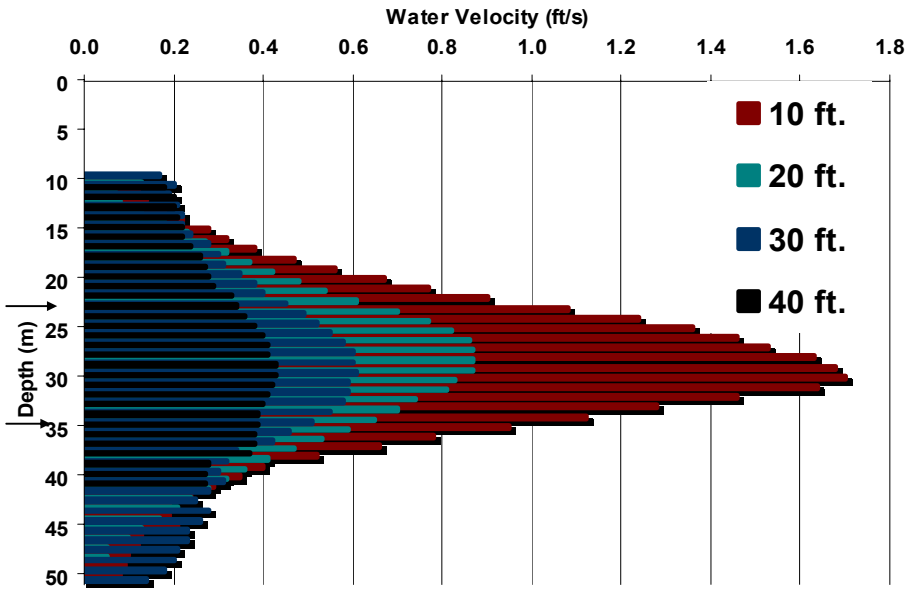


Figure 4. Water velocities (ft/sec) in front of turbine three at given distances (10, 20, 30, & 40 ft) upstream of the dam, along a transect centered on the intake opening. The two black arrows mark the upper and lower depths of the intake opening.

**Dworshak Quarterly Reports contain preliminary data and conclusions that are not citable.**

## Strobe Light Tests

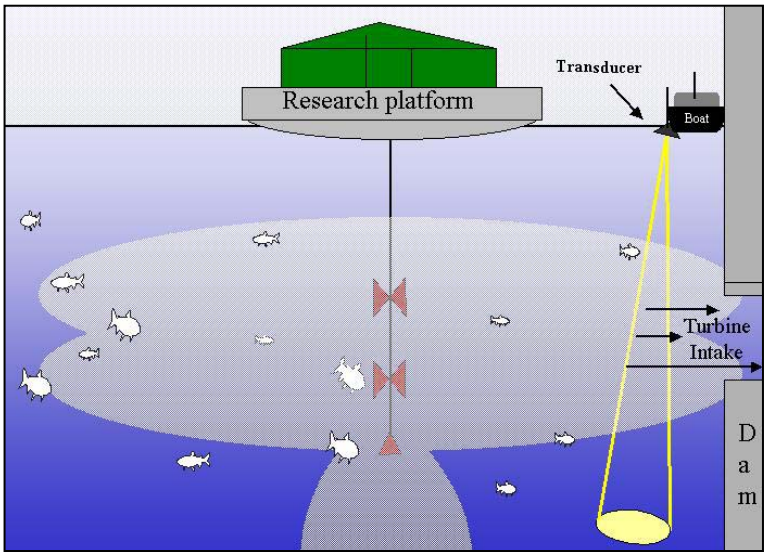


Figure 5. Diagram depicting methods to assess effectiveness of underwater strobe lights to deter kokanee entrainment through Dworshak Dam turbine intakes.

During this quarter, we also finished five replicates of paired strobe light effectiveness tests between January 26th and February 24th, 2004. One set of nine strobe lights was lowered in front of each of two operating turbine intakes, units one and two. Each paired replicate consisted of one control night (strobe lights off) and one test night (strobe lights on).

On the hour, throughout each night, a hydroacoustic survey transect was conducted parallel with the face of the dam between the lowered strobe lights and the turbine intakes (Figure 5). Transects documented the density and distribution of kokanee with the lights on or off respectively.

We are currently analyzing the hydroacoustic results from this series of strobe tests, but so far the results look encouraging. Although the density of fish was low during controls (lights off), it appears there are far fewer fish near the turbine intakes with the lights on than off. Complete analysis results will soon be available.

## Internet Links to more info:

**Are you looking for past quarterly and annual reports concerning Dworshak Reservoir ?**

They can be found on Idaho Fish and Game's website at (**http://fishandgame.idaho.gov/tech/reports**). Click on the **Fisheries** link, then do a word search on '**Dworshak**'.

## Next Quarter's Activities

During the next quarter, we will continue entrainment and forebay density surveys. We will especially concentrate our effort upon entrainment sampling in front of the ROs, if utilized this spring to discharge water from the reservoir. Strobe light effectiveness testing will also be conducted using two sets of strobe light systems simultaneously in front of two operating turbines or ROs, assuming fish densities near the dam increase and turbine or RO operations permit.

We will finish writing the 2003 annual report and 2nd quarter report, finish the analysis of strobe light effectiveness tests, and continue analysis and interpretation of entrainment echograms.

Next quarter we will also start limnological sampling and trawling to assess the effects of dam operations on primary and secondary production (and potential loss); and influence on annual kokanee population stability (density, length-at-age, growth, and survival).

Lastly, Eric will attend a training workshop on Sonar Data™ - Echoview 3.1 hydroacoustic data post-processing software, to more effectively analyze and interpret our entrainment sampling echograms.

Questions and comments on Dworshak Quarterly reports should be addressed to:

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Illustration by
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